

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for November, 1897, is based on 2,864 reports from stations occupied by regular and voluntary observers, classified as follows: 144 from Weather Bureau stations; numerous special river stations; 33 from post surgeons, received through the Surgeon General, United States Army; 2,525 from voluntary observers; 96 received through the Southern Pacific Railway Company; 14 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 32 from Canadian stations; 20 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist,

Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are generally corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

STORM WARNINGS AND WEATHER FORECASTS.

By Lieut. Col. H. H. C. DUNWOODY, Supervising Forecast Official.

Under this head it is proposed to make note of all extreme and injurious weather conditions occurring during the month, and the warnings of the same issued by the Bureau, with instances, as far as reported by observers or the press, in which these warnings were of special public benefit. The signals displayed by the Weather Bureau will be referred to as "information," "storm," "hurricane," "cold wave," and "norther," respectively.

The following report on the work of November has been prepared by Mr. H. E. Williams, Chief of Forecast Division.

SEVERE STORMS.

Only three storms of note occurred during the month, viz: Those of November 3-6, 7-10, and 9-12.

The first of these storms originated in western Kansas and moved from Iowa northeast over Lake Michigan and northern Lake Huron on the 5th, and thence easterly to the Gulf of St. Lawrence on the 6th, causing high easterly to northerly winds on the upper, and violent southerly to westerly gales on the lower lakes, a maximum velocity of 60 miles from the west being reported from Buffalo on the morning of the 6th.

Signals for this storm were ordered on western Lake Superior at 5:30 p. m. of the 3d, on Lakes Superior, Michigan, and Huron at 9:40 a. m. of the 5th, on Erie at daybreak of the 5th, and on Ontario at 2:30 p. m. of the 5th. This was the storm in which the ill-fated *Idaho* was lost on Lake Erie.

This vessel left Buffalo harbor on the afternoon of the 5th in the face of the storm signals which had been flying there since daybreak.

The second storm developed in Kansas, passed across the lower Lake Region on the 9th, and moved into the Atlantic off the east New England coast on the 10th, causing unusually low pressures along its track, a barometer reading of 29.06 at Oswego at 1 p. m., 29.00 at Portland, and 29.08 at Eastport at 8 p. m. of the 9th, and 28.98 at Halifax at 8 a. m. of the 10th being noted. The highest winds were 44 northwest at Cleveland and 38 northwest at Buffalo during the forenoon, and 40 northwest at Oswego, 56 west at New York, and 60 southwest at Block Island during the afternoon of the 9th. Signals were ordered on eastern Lakes Superior, Michigan, and Huron at 6 p. m. of the 8th, on Erie and Ontario at daylight of the 9th, and on the Atlantic coast from Delaware Breakwater to Eastport at 9:50 a. m. of the 9th.

The third storm appeared north of Montana on the 9th and moved southeast over Lakes Superior and Michigan on the 10th, the center crossing north of the lower Lake Region on the 11th, and passing off the New England coast on the 12th. Velocities of 56 miles at Chicago, 42 at Grand Haven, and 36 at Alpena occurred during the night of the 10th; 48 at Grand Haven, 38 at Sault Ste. Marie, 68 at Cleveland, and 46 at Buffalo during the 11th; 56 at Cleveland, 42 at Erie, 48 at Buffalo, 46 at Boston, and 52 at Eastport during the

night of the 11th; and 44 at Cleveland, 56 at Buffalo, 36 at Oswego, 38 at New York, and 48 at Block Island during the 12th. Signals were ordered on Superior at 10:10 a. m. of the 10th, on Michigan and Huron at 2:30 p. m. of the 10th, and on Erie and Ontario at 9:50 p. m. of the 10th, and from Hatteras to Eastport at 2:30 p. m. of the 11th.

COMMENTS OF THE PRESS.

As showing the value of these warnings and the estimation in which they were held by the interests served, the following extracts are given from newspapers published in cities where signals were displayed, viz:

Editorial, Chronicle, Chicago, Ill., November 4, 1897.—The heavy gales of the last few weeks have demonstrated both the accuracy of the local weather predictions and the seaworthiness of the lake marine. Vesselmen had ample warning of the blow, and many of them deemed discretion the better part of valor and remained in port. Others, however, dared the fury of the 60-mile gale, and it is a tribute to their seamanship and to the stanchness of their vessels that all weathered the blast without serious damage. In point of fact, the sailors of the Great Lakes are inferior to none in the world, and their craft have proved their stability in storms as severe as any that sweep the Atlantic.

Editorial, The Times, Buffalo, N. Y., November 13, 1897.—The captain of the ill-fated *Idaho* went out Friday afternoon, after the weather bureau had warned mariners that a fierce gale was approaching. On Thursday the warning was given: "Sailing vessels and steam barges with tows should use caution where destination can not be reached by Friday evening, as brisk, south winds will become westerly, increasing in force to high."

Storm signals were ordered up Thursday evening, and Friday morning warning was given that the storm and accompanying gale had moved northward to Lake Michigan. Many vessels heeded the warnings and stayed in port, but Captain Gillies, who went down with his wrecked vessel, thought he could weather the storm. The result shows the wisdom of making use of all the safeguards against the dangers of navigation at this perilous season that can be provided. Marine men ought to learn a lesson from the fate of the *Idaho* and its crew.

Leader, Cleveland, Ohio, November 12, 1897.—The storm which swept over the city all day and during the night was decidedly severe. During the early evening and during the night the gale fluctuated between 50 and 67 miles, the latter velocity being within 6 miles of the highest wind ever recorded by the Cleveland weather station. The warning of an approaching storm sounded by the weather department twenty-four hours previous to its arrival was heeded by vessel men as a general rule, the result being the suspension of navigation.

Editorial, Chronicle, Chicago, Ill., November 12, 1897.—The wreck of the steamer *Idaho*, with the loss of twenty lives, off Long Point, last week, points a moral and adorns a tale for lake mariners. The disaster was the result of carelessness and temerity. The *Idaho* was thirty-five years old, and, though not exactly unseaworthy, should not have been exposed to a severe storm. The storm signals were flying when the boat put out of the port of Buffalo to make its way up Lake Erie. Captain Gillies trusted to his own judgment instead of to the warnings of science. He also trusted in the stoutness of an old craft, not fitted for the severe tempests of the season. Small as it is, Lake Erie sees the worst storms that sweep across the lake basin.

We are accustomed to jeer at the Weather Bureau when unheralded storms carry devastation in their tracks across land and sea. Sometimes, perhaps often, forecasts of storms are not fulfilled; but this is only in the case of minor changes from calm to disturbance not seriously affecting navigation nor the pursuits of trade and labor on land. Serious warnings are seldom without cause.

The World, Cleveland, Ohio, November 13, 1897.—From November 1 up to date there have been almost continuous storms all over the Lakes, as was predicted by Inspector Beals, of the local weather office. Despite these storms, however, there were very few accidents reported, save the sinking of the *Idaho*, and her master disobeyed orders in sailing from port when warned of an approaching storm. The storm signals issued at the local office have been true in every instance, and marine men are beginning to look upon the predictions with more credence than ever before.

Plain Dealer, Cleveland, Ohio, November 13, 1897.—The storm of Thursday was one of the severest known in the vicinity of Cleveland, but, owing to the timely warning from the weather bureau, no great damage was done to shipping interests. In fact, every storm this fall has been heralded from twelve to twenty-four hours before its approach, so that all had ample time to be prepared.

The Times, Buffalo, N. Y., November 14, 1897.—The timely warnings of the local weather bureau prevented many vessels from leaving port ten days ago, when the storm prevailed on the Lakes in which the unfortunate steamer *Idaho* went down. At the time of this wreck this paper pointed out that no blame could be attached to Forecaster Cuthbertson's office at any rate, for the office had done its full duty in warning merchants against the dangers of leaving port then.

Again, during the past week the local weather bureau has done the navigation interests invaluable service. It has given warnings of the storms which have prevailed during the week, and undoubtedly has in this way saved two or three million dollars' worth of property, and nobody knows how many lives. Yesterday morning 50 vessels left port after waiting for the storm to blow over. Certainly the navigation interests of the Queen City of the Lakes could ill afford to do without the services of the weather bureau.

Detroit Tribune, Detroit, Mich., November 12, 1897.—The weather bureau at this point issued warnings of the approaching storm last Wednesday and at once ordered up storm signals at points along the entire chain of lakes. The orders were repeated yesterday morning. That much attention was paid to the signals is shown by the fact that the vessel passages at Detroit yesterday were among the lightest in number on record.

Detroit Free Press, Detroit, Mich., November 12, 1897.—It is a fact deserving of praise that every storm this month was seen in the distance and predicted long before it reached the Lakes. For a period of twenty-four to thirty-six hours ahead, the inhabitants of the Lake Region have been told of the coming of each; and as it came closer and immediate conditions could be gauged the public had been given exact details, including direction and velocity of the wind. Some men say this is a matter of luck. There is some excuse for this remark in view of the utter failure of predictions in times past. But there is another side to it. The bureau has, without doubt, been brought to a high state of efficiency. The chief and his assistants have profited by past experience just as every man of sense takes warning of what has gone before, and endeavors to improve on his record. The science of studying the origin and tracks of storms has been refined, and the process of refinement has by no means been completed. New instruments have had much to do with this, but study and application and reasonable deductions have had more.

The natural result is the greater respect paid the bureau, its bulletins, and charts than ever before. The November chart,* containing diagrams of the courses of past storms for that month, has jumped into popular favor. Requests for it are made every day by lake masters, owners, and others. More heed is taken of storm warnings, for the lake sailor has come to look on them as worthy of trust. The one great exception was the starting of the steamer *Idaho* from Buffalo last Friday. The prediction of that storm and its attendant conditions had been made many hours before.

In regard to the storm of the 7-10th, for which signals were ordered on the New England coast at 9:40 a. m. of the 9th, the observer at Block Island reports:

The warnings were thoroughly distributed among the shipping interests, and especially among those interested in fishing.

The wind from the southwest was severe, reaching on the 9th a maximum velocity of 48 miles, and an extreme velocity of 60 miles per hour at 4:08 p. m. The wind attained a much higher velocity on the southwest part of the island, as it is about 150 feet above the office building, and less than a mile distant from it; other obstructions, such as high buildings have a tendency to reduce the wind record. About 8 p. m. the wind changed to northwest and increased in velocity during the night, reaching a maximum velocity of 54 miles per hour at 9:15 p. m., but as the same conditions exist with a northwest wind as with a southwest, we were prevented from obtaining a true velocity. Old reliable residents on the south part of the island inform me that it was one of the severest storms they have ever experienced on that part of the island, and it is estimated that the wind must have attained a hurricane velocity, as it did more damage toward tearing down stone walls, blowing over haystacks, etc., than it usually does with a wind of 60 miles per hour recorded at this office. It is estimated that the damages sustained by the storm on the island will reach \$500.

The following fishing smacks dragged anchors in the Great Salt Pond harbor during the northwest wind and went ashore:

Schooners *Arabell*, *Maud Gertrude*, *Annie M. Eliza*, *Valliant*, and sloop *Valkyrie*. They will all be floated at high water excepting smack *Valliant*, which is a very old craft and not worth hauling off.

It is estimated that the amount of damage done to shipping in the harbors, such as carrying away sails, etc., including loss of *Valliant*, will amount to about \$1,000. There were about 40 fishing smacks in the harbors, representing a total value of about \$70,000, 175 men comprising the crews of the above vessels, who heeded storm warnings and remained in port till the warnings were lowered. The light keeper at Southeast lighthouse informs me that the light tower felt the effects of the wind more than any storm for a long time; it caused the tower to tremble quite severely.

COLD WAVES, FROSTS, ETC.

No cold waves of marked severity occurred during the month. Such cold waves as did occur were amply forecast, and the warnings of them were of considerable benefit.

*The Meteorological Chart of the Great Lakes for November, 1897, published by the Weather Bureau for the use of navigators.

Frosts occurred in the Gulf and South Atlantic States, as follows, viz, on the 3d light frosts in the southern and heavy in the northern portions of Alabama and Mississippi; on the 4th heavy frosts in Alabama, Mississippi, and Georgia, and light in northern Florida; on the 13th light frosts in North Carolina, South Carolina, and northern Florida; on the 17th killing frosts in northern Louisiana and Mississippi; on the 18th light frosts on the Gulf and south Atlantic coasts, and killing in the central portions of the Gulf States and in North Carolina. Warnings of these frosts were issued in every case twenty-four hours, and in some cases forty-eight hours, in advance.

On Tuesday, the 16th, a special bulletin issued by the Bureau announced that—

The most decided cold wave of the season is indicated for Wednesday morning throughout the yellow fever districts of the South.

Freezing weather probably will occur throughout the northern and central portions of the Gulf States and in the Ohio Valley Wednesday morning, and frosts generally throughout the Southern States Wednesday and Wednesday night.

And the observer at New Orleans was directed to warn postmasters in the sugar regions of the probable occurrence of freezing weather in the western portion of those districts.

COMMENTS OF THE PRESS.

The following remarks in regard to the warnings of cold waves issued by the Bureau are extracted from the respective newspapers:

Journal, Sioux City, S. Dak., November 22, 1897.—Warnings of these sudden changes of temperature are widely distributed by the Weather Bureau, and are of immense value to all classes of business. The distribution is made through the medium of the newspapers, the telephones, the telegraph, and by means of special bulletins. In Sioux City the two telephone exchanges have about 1,700 subscribers. The central offices receive cold weather warnings from the observer and notify all subscribers who wish such notification. The number taking these warnings is large, consisting largely of commission men, railroad officials, and others having to do with perishable products. If a commission man has perishable freight en route when a cold wave warning is issued he orders it into a roundhouse or other warm building until the danger is past, or he refrains from shipping until the weather becomes more favorable; and, again, the warning is of great value to him in his local business, as certain kinds of fruit can not be exposed to a cold wind without injury.

The value of cold wave and frost warnings is mentioned by the Chief of the Weather Bureau in his annual report for 1896. He says: "Particular attention is called to the cold wave of unusual severity that overspread nearly the entire United States east of the Rocky Mountains on January 2 to 5, 1896. Warnings of this wave were sent at least twenty-four hours in advance to nearly every station in its path. The Weather Bureau observers at the stations visited by the cold wave report an estimated saving on account of the warnings of over \$3,500,000. The estimate, from the nature of the case, could be a partial one only. It is interesting to note the variety of industries benefited. Owners and shippers of perishable produce protected their property from injury by frosts or freezing; owners of residences, factories, and distilleries, and custodians of hospitals and public buildings protected water pipes to prevent bursting; railway officials regulated the size of trains; florists and truck growers protected their hot-houses and growing crops; farmers in the south slaughtered their cattle and hogs; river men protected their boats and stock raisers their cattle. In the State of Florida alone, where a large quantity of early garden truck was above ground, the actual figures given by the truck raisers themselves showed a saving by this warning of over \$300,000, and this was necessarily only a partial estimate."

The appropriation for the maintenance of the Weather Bureau is about \$900,000 per annum, so it will be seen that the saving by reason of this one warning was sufficient to pay the cost of the whole Bureau for a year several times. "This estimated saving is not a wild guess," said Mr. Fursell. "It is not made by the observers, but by the business men themselves, by the men who are liable to loss from sudden changes in temperature. As the report of the Chief says, it is but a partial estimate, and very likely is a good deal short of the amount actually saved. It illustrates, however, the value of the Bureau and its warnings to the business interests of our country."

The Evening Star, Washington, D. C., November 18, 1897.—Many colds have been "caught" by imprudent ones who did not give full credence to the warning given by the Weather Bureau Tuesday that it would be "decidedly colder" Wednesday morning. This warning was amply justified, and its success should encourage some skeptics to place more

faith in the forecasts of this branch of the Government service, which works under so many handicaps and with such elusive elements."

In regard to the forecasts and warnings issued during the month for Montana, probably one of the most difficult districts for which to make accurate forecasts, because it is so near the border of the region of observations, the Observer at Havre reports:

More than usual interest has been manifested by the residents in this vicinity, in the daily weather forecasts, during this month (November). With but one exception, the 8th instant, the forecasts for Montana have been so thoroughly verified in this neighborhood that no improvements could be made unless the public should want the exact hours, etc., when the expected weather changes would take place.

The cold-wave warning, forecasts of warmer to-night, rising temperature, snow, continued cold, etc., were all verified to the letter. The warning of the cold wave on the 19th was distributed by extra copies of bulletin, Form No. 1036—Met'l, and cold-wave flag displayed. Special forecast of "High winds, snow, and much colder to-night," Sunday, November 14, was distributed in hotels, open business houses, and elsewhere, and flags displayed.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During November the tracks of 7 highs and 8 lows have been sufficiently well defined to be traced, and are charted on Charts I and II. The following table shows the date and place of origin and disappearance and the duration and velocity of apparent translation of each high and low.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.							<i>Miles.</i>	<i>Days.</i>	<i>Miles.</i>	<i>Miles.</i>
I.....	29, p. m.	49	124	5, p. m.	47	80	4,580	7.6	594	27.3
II.....	1, p. m.	47	125	8, a. m.	31	80	5,280	9.5	505	21.0
III.....	6, a. m.	37	124	14, p. m.	34	76	4,100	9.5	432	20.1
IV.....	14, a. m.	54	118	22, a. m.	29	87	4,090	9.6	511	21.3
V.....	19, p. m.	54	115	26, a. m.	48	55	4,030	9.5	620	25.3
VI.....	27, a. m.	52	106	29, a. m.	47	62	2,590	9.6	563	26.0
VII.....	27, a. m.	50	114	30, p. m.	57	74	2,450	8.5	700	29.2
Total.....							25,120	43.0	4,335	.....
Mean of 7 tracks.....							3,589	.....	619	23.8
Mean of 43 days.....							.....	.....	584	24.3
Low areas.							<i>Miles.</i>	<i>Days.</i>	<i>Miles.</i>	<i>Miles.</i>
I.....	29, p. m.	54	106	3, p. m.	48	52	3,940	5.0	788	32.8
II.....	2, p. m.	44	102	7, p. m.	49	52	3,000	5.0	600	25.0
III.....	6, p. m.	38	99	10, a. m.	49	53	2,700	4.0	675	28.1
IV.....	9, p. m.	52	111	13, a. m.	47	56	2,850	3.5	570	28.8
V.....	11, a. m.	48	128	17, p. m.	46	55	3,970	6.5	611	25.4
VI.....	17, a. m.	47	127	22, p. m.	48	55	3,570	5.5	704	29.2
VII.....	20, a. m.	50	126	27, a. m.	48	67	4,000	7.0	571	25.8
VIII.....	23, p. m.	42	87	30, p. m.	46	58	1,610	2.0	805	33.5
Total.....							25,940	38.5	5,324	.....
Mean of 8 tracks.....							3,242	.....	665	27.7
Mean of 38.5 days.....							.....	.....	674	28.1

HIGHS.

The general tendency during the month has been for highs to begin or first appear to the north of Montana and take a general southeast track, disappearing off the south Atlantic Coast. Highs Nos. I, II, and III could be traced back to the Pacific Coast; the four last of the month were first noted in Alberta. The highest pressure and lowest temperature of the month occurred in connection with No. VI, on the morning of the 26th, when 31.02 inches and -32° was experienced at Swift Current. The greatest change in temperature and severest cold wave occurred during the prevalence of high area No. V, to the north of Montana. The a. m. observation of the 20th showed a fall in temperature of 46° in twenty-four hours at Havre and of 44° at Helena. The next evening the fall at Helena was 52° , at Rapid City 48° , and at Bismarck 42° . By the morning of the 21st the fall at Rapid City was 46° , at Huron 44° , and at Pierre 43° .